SAIC
1300 N. 17th Street
Suite 1450
Arlington
VA 22209

Group2 Consortium

Data Delivery Plan (Phase 1)

Seismic Calibration for IMS Stations in North Africa and Western Asia

Group 2 Consortium: *SAIC, University of Colorado, Harvard University, University of California San Diego, Geophysical Institute of Israel, and Multimax*

Table of Contents

Data Delivery Plan (Phase 1)

Title: *Seismic Calibration for IMS Stations in North Africa and Western Asia (Group 2)*

Contractor: *Science Application International Corporation*

Point of Contact: *Dr. Keith McLaughlin*

1300 N. *17th Street, Suite 1450*

Arlington, VA 22209

Email: scatter@cmr.gov,

Phone: 703-247-4135

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Objective of the Delivery

SAIC, University of Colorado, Harvard University, University of California San Diego, Geophysical Institute of Israel, and Multimax will develop, test, validate, and deliver seismic location calibrations for IMS stations in North Africa and Western Asia. The project will focus on improving location accuracy, reducing error ellipses and developing calibration products that work with IDC software. Travel-time corrections will be developed, tested, and validated in two phases over three years. In this first phase, readily available models will be used to produce and deliver a preliminary set of P- and S-wave regional source-specific station corrections (SSSCs) for all Group 1 IMS stations out to 20 degrees.

The primary deliverables from the consortium will be: (a) Travel time correction surfaces with associated errors, e.g., SSSCs; (b) Seismic models that is used to construct these models; (c) Ground truth datasets which will be used in the *test plan* to validate the performance of the correction surfaces.

Summary of Technical Deliveries

The products to be submitted to the R&D test bed include the SSSC calibration surfaces for each station in the Group2 region (Figure 1), a reference event dataset to validate the SSSCs and a detailed test plan to verify the improvement in using the SSSC surfaces. This data delivery plan covers only the deliveries to be made as part of Phase 1. This data delivery plan includes a rough schedule for deliveries, unit testing, integration testing, and draft descriptions of the deliveries. This data delivery plan includes a rough sketch of the intended unit and integration test plans. This delivery plan includes several templates provided by the R&D TB for documenting data deliveries and test plans. The project deliverables include:

1. **SSSCs (Source Specific Stations Corrections) [To be delivered in June 2001]**
   For each planned IMS station in the group the following characteristics:

- Formatted in accordance with IDC data file structure (currently rectangular lat/lon)
- Separate traveltime corrections for the regional phases Pn, Pg, Lg, and Sn
- The corrections at each grid point will be accompanied with estimated uncertainties (model errors)
- The area covered by the grids will extend to 20° from each station; Pg will be given up to 10°
- The horizontal grid spacing will be 100 km or less
- The grid system will have sources at a depth of 10 km
- The performance of the grid system for event location will be validated with ground truth data independent of the derived grids

2. **Velocity Models [To accompany the CCB proposal]**
   The models, on which the delivered SSSCs are based, will be part of the products of this proposal.

3. **Ground Truth Data [To be delivered in June, 2001]**
   GT events in the Group2 region will be delivered to the R&D TB according to pre-defined database schema. Ground truth data compiled for the testing, evaluation, and validation of SSSCs will be submitted with for the delivery tests. We expect the ground truth datasets for the tests to be GT05 or better.

4. **Documentation [To accompany the CCB proposal]**
   Technical reports will be prepared detailing each of the products listed above.

Delivery of Metadata

The metadata will consist of the following:

1) The three-dimensional Earth model including estimates of model error that is used to derive the SSSCs will be delivered. The models will be in

formatted *flatfiles* and we will coordinate with the R&DTB personnel to convert them to ORACLE databases (schema to be developed; we will probably use the DOE schema)

2) The documentation that will accompany the delivery will consist of:

    a) Description of the 3-D models, including parameterization, formats, coverage (if it is not a global model), data sources, lateral and radial resolution (if available) and bugs and caveats. If other models (e.g., CRUST5.1) have been used to derive or fill in parts of the submitted, a reference will be provided.

    b) References to studies used in deriving this model.

    c) Published papers or reports that describe the construction of these models, in detail.

3) Background Information: a brief description of each datasets that were used to construct the model.

    a) Love and Rayleigh wave dispersion curves, including period range and path coverage.

    b) Body wave travel times, including phases, distance range and station coverage.

Schedule of Phase 1 Delivery Plan

1) Stand alone (Unit) test plans:

    Date: March 2001

    Components:

    A complete unit test plan for Phase 1, including:

    a) EvLoc relocation scripts

    b) SSSCs and configuration files to be loaded

    c) GT datasets required for the test installation

    d) Test database installation scripts

    e) Metrics for testing system improvement (with scripts)

    f) Regression test scripts

2) Integration test plans:

Date: June 2001 (No later than July/August and only if unit testing is successful)

Components/Assumptions:

a) ARS environment needs to be running

b) REB: 1-2 days of events to be re-analyzed

c) PIDC Configuration files

d) Analyst time to re-analyze REB events

e) Metrics for testing system efficiency and runtime

3) Phase 1 CCB Proposal

Date: August 2001

Components:

a) CCB proposal in a standard format summarizing unit and integration testing results

b) Appendices describing detailed unit and integration tests

c) Appendices documenting velocity models and metadata

d) All configuration files including SSSCs required for installation

e) Velocity models, GT data, metadata

Delivery Components

The following are preliminary descriptions for the components to be delivered. Details may differ at time of delivery.

Research and Development Test bed
Velocity Models

I: Component Overview

A) Describe the purpose of the component and its features.
Seismic velocity model to generate traveltimes.

B) Describe any required inputs.
a) Seismic model
b) Flat File Format:
Lat / Lon / # of knots
Knot # / depth / vs / vsh / vsv / vp / r / Q

C) Describe the output
a) Plots of lateral and radial model slices.
b) Model parameter table (1)
c) Model definition table (2)

D) Disposition of the delivery
a) Receive and store delivery
b) Archival and database.

II: System Requirements

A) Hardware Requirements
1) Machine Type
Sun/Unix
2) Memory
N/A
3) Disk Space
Flat files: 20 – 30 Mb
Oracle: TBD
4) Expected Network Load
N/A
5) System Load/CPU
N/A
6) Backups
N/A
7) Other (graphics, printers, etc)
Postscript Viewer, color printer.

B) Software Requirements
   1) OS version and patch level
      Solaris (Current)
   2) Database version and patch level
      Oracle (Current)
   3) Other COTS Software
      Fortran and C compilers
      C-shell, Perl, Unix utilities (awk, grep, sed, etc.) , GMT
      Word Processing: MS Word, Latex

C) Configuration Requirements
   1) Parameter Files and type
      TBD (format and description will be supplied)
   2) Configuration Trees
      TBD
   3) Log Files
      N/A.
   4) External Events
      N/A
   5) Interaction with other components
      With SSSC computation software (part of separate delivery)
   6) Scripts
      Sample scripts
   7) Cleanup
      Uninstall scripts will be provided
   8) Maintenance
      One time installation.

III: Support Requirements

A) System Administration Staff Support and man hours
   Less than one man-day
B) DBA Staff Support and man hours
   Less than one man-hour
C) Integration Staff Support
   Less than one man-day
D) Development Staff Support
   N/A
E) Operations Staff Support
   N/A
F) Special Account Access
   ORACLE account for the Group 2 Consortium (user: group2db).

IV: Evaluation

A) Describe how to evaluate the component.

Sample codes and test cases will be supplied to check if the model has been properly installed. R&D TB personnel may use those scripts to generate graphics outputs of the model for installation validation.

B) Final Report

TBD

V: Testing Schedule

N/A

Research and Development Test bed
SSSC surfaces

I: Component Overview

A. Describe the purpose of the component and its features.
SSSC surfaces to apply traveltime corrections

B. Describe any required inputs.
SSSC surfaces for each station (~ 30) and four separate phases (total ~ 120), which will be provided to the test bed. Correction surfaces for ~ 100 surrogate stations (TBD) will also be provided.

C. Describe the output

D. Plots of surfaces

E. Flat files for SSSCs

F. Disposition of the delivery

a) Receive and store delivery
b) Archival and database
c) Incorporate into ARS configuration

II: System Requirements

A) Hardware Requirements

1) Machine Type
Sun/Unix
2) Memory
N/A
3) Disk Space
Flat files: 20 – 30 MB
Oracle: TBD
4) Expected Network Load
N/A
5) System Load/CPU
N/A
6) Backups
N/A
7) Other (graphics, printers, etc)
GMT, Postscript Viewer, color printer.

B) Software Requirements

1) OS version and patch level
Solaris (Current)
2) Database version and patch level
Oracle (Current)
3) Other COTS Software

Fortran and C compilers
C-shell, Perl, Unix utilities (awk, grep, sed, etc.)
Word Processing: MS Word, Latex

C) Configuration Requirements

1) Parameter Files and type
   ars.defs, ARS.par, EvLoc.par
2) Configuration Trees
   $CMS_CONFIG/earth_specs/TT/vmsf/
   $CMS_CONFIG/earth_specs/TT/iasp91/SSSC
   $CMS_CONFIG/app_config/interactive/ARS
3) Log Files
   N/A.
4) External Events
   N/A
5) Interaction with other components
   With location software (EvLoc)
6) Scripts
   Sample scripts
7) Cleanup
   Uninstall scripts will be provided
8) Maintenance
   One time installation.

III: Support Requirements

A) System Administration Staff Support and man hours
   Less than one man-day
B) DBA Staff Support and man hours
   Less than one man-hour
C) Integration Staff Support
   Less than one man-day
D) Development Staff Support
   N/A
E) Operations Staff Support
   N/A
F) Special Account Access
   A separate account on the R&D TB to do the testing as we will not use the group2db account for this purpose.

IV: Evaluation

A) Describe how to evaluate the component.
   Sample codes and test cases will be supplied to check if the SSSCs have been properly installed. R&D TB personnel may use those scripts to generate graphics outputs of the model for installation validation.

B) Final Report
Part of CCB.

V: Testing Schedule
TBD

Research and Development Test bed
Ground Truth Datasets

I: Component Overview

A. Describe the purpose of the component and its features.
Ground truth datasets in the Group2 region

B. Describe any required inputs.
Locations of the events and phase arrival times

C. Describe the output
Database tables for the GT events

D. Disposition of the delivery
i. Receive and store delivery
ii. Archival and database

II: System Requirements

A) Hardware Requirements

1) Machine Type
Sun/Unix

2) Memory
N/A

3) Disk Space
I. Flat files: TBD (< 20 MB)
II. Oracle: TBD (< 10 MB)

4) Expected Network Load
N/A

5) System Load/CPU
N/A

6) Backups
N/A

7) Other (graphics, printers, etc)
GMT, Postscript Viewer, color printer.

B) Software Requirements

1) OS version and patch level
Solaris (Current)

2) Database version and patch level
Oracle (Current)

3) Other COTS Software
Fortran and C compilers
C-shell, Perl, Unix utilities (awk, grep, sed, etc.)
Word Processing: MS Word, Latex

C) Configuration Requirements

1) Parameter Files and type
   GT event database tables: ASCII and Oracle binary dumps
2) Configuration Trees
   TBD
3) Log Files
   N/A.
4) External Events
   N/A
5) Interaction with other components
   N/A
6) Scripts
   Sample scripts
7) Cleanup
   N/A
8) Maintenance
   One time installation.

III: Support Requirements

A) System Administration Staff Support and man hours
   Less than one man-day
B) DBA Staff Support and man hours
   Less than one man-hour
C) Integration Staff Support
   Less than one man-day
D) Development Staff Support
   N/A
E) Operations Staff Support
   N/A
F) Special Account Access
   ORACLE account for the Group 2 Consortium (user: group2db).

IV: Evaluation

A) Describe how to evaluate the component.
   Sample codes and test cases will be supplied to check if the events have been properly loaded. R&D TB personnel may use those scripts to generate graphics outputs of the location for installation validation.
B) Final Report
   Part of CCB.

V: Testing Schedule

N/A

Research and Development Test bed
Stand-Alone (Unit) Test Plan for SSSC surfaces

General Test Information

A) Test plan author: *TBD*
B) Test plan completion date: *March, 2001*
C) Component description:
   I. *Unit Testing: This test is carried out to evaluate the improvement in seismic event location using a newly derived set of SSSCs for the Group2 stations compared to what is currently being used in the operational pipeline This test will also validate the offline testing carried out by the Group2 personnel.*
   II. *SSSC correction surfaces, in a regular latitude/longitude grid, will be submitted. There will 120 separate surfaces, for 30 stations. For each station, four seismic phase specific (Pg, Pn, Lg and Sn) surfaces will be submitted. In this delivery, the SSSCs will be used for a source at 10 km.*
   III. *Ground truth datasets: Several lists containing location, arrival time and accuracy (e.g., GT0, GT05 etc.), will be submitted. These dataset, which will be a subset of the GT dataset that will accompany this delivery, will be used to test the location accuracy using the SSSCs.*
   IV. *Scripts to run the tests, EvLoc configuration files and CMSS configuration tree will be submitted*
   V. *Documentation: Installation description and requirements.*
D) Test assumptions, limitations, exceptions, constraints:
   I. *The earthquakes are in the crust*
   II. *SSSCs extends only up to 20°*
   III. *The system has enough memory for accessing several SSSCs*
E) Tested requirements:
   I. SSSC surfaces are readable by the R&D test bed *(exact number of surfaces: ~ 120)*
   II. EvLoc configuration is appropriate.

Test Objectives

A) General Objectives:

Demonstrate that the SSSCs are usable and there is significant performance improvement of the seismic event location software.

B) Test Cases:
   I. *Regression tests will be performed for the section "E" above.*
   II. *Several GT datasets (TBD) will best tested for location improvement.*

Test Case

A) Conditions exercised by this test case:

Location accuracy and error ellipse coverage of GT datasets

B) Type of test and extent of testing: *(X those that apply)*

[X] Normal Operations. Exercises entire unit through its most typical logic path.

[ ] Logic Path. Exercises most critical logic paths.

[ ] Boundary. Exercises minimum, maximum, and null values for critical data items.

[ ] Negative. Exercises invalid, out-of-bound values, error handling, error messages.

[ ] Other. Exercises other conditions (e.g. database access, performance times, etc.).

C) Test Case Description:

Will be specific for each GT dataset

D) Test Case Environment:

Machine: *UNIX (SUN)*

Operating System: *Solaris*

Oracle version: *Current*

Database Account: *group2db*

Other COTS software required: *Unix shell, Perl, Fortran and C compilers.*

E) Test Case Input Values:

I. *SSSC flatfiles and EvLoc configuration files*
II. *Scripts to run the tests*

F) Test Case Results:

I. *Statistics of the relocation experiments.*
II. *Plots that show the relocations and the error ellipses.*
III. *Updated location databases*

G) Test Case Procedure:

TBD (will involve running a set of scripts)

H) Expected output values:

I. *Database of SSSCs*
II. *Flat file of test results.*
III. *Metrics: changes in location, area of the error ellipse and confidence bounds. Will be provided as part of the test plan.*

I) Test Case Evaluation Criteria:

Will be provided as part of test plan but will include metric script(s) to quantify improvement in location and run time should not degrade significantly (amount TBD) when the SSSCs are turned on.

Research and Development Test bed
Stand-Alone Test Plan for Ground Truth Data

General Test Information

A) Test plan author: *TBD*
B) Test plan completion date: *March, 2001*
C) Component description:
   I. Ground truth datasets: Several lists containing location, arrival time and accuracy (e.g., GT0, GT05 etc.) will be provided to the R&D TB.
   II. Documentation: Installation procedure and requirements (TBD) will be provided.
D) Test assumptions, limitations, exceptions, constraints:
   I. Database schema for archiving GT events is available
   II. The system has enough disk space (TBD) for archiving the datasets
E) Tested requirements:
   I. The GT information is readable by the R&D test bed
   II. Plotting software (preferably GMT) is available for regression tests

Test Objectives

A) General Objectives:
Demonstrate that the GT events have properly archived in the R&D TB
B) Test Cases:
   I. Regression tests will be performed for the section "E" above.
   II. *Several GT datasets (»5 – 10) will best tested*

Test Case

A) Conditions exercised by this test case:
Locations and arrival times for the GT events
B) Type of test and extent of testing: *(X those that apply)*
[X] Normal Operations. Exercises entire unit through its most typical logic path.
[ ] Logic Path. Exercises most critical logic paths.
[ ] Boundary. Exercises minimum, maximum, and null values for critical data items.
[ ] Negative. Exercises invalid, out-of-bound values, error handling, error messages.
[ ] Other. Exercises other conditions (e.g. database access, performance times, etc.).
C) Test Case Description:
TBD
D) Test Case Environment:
Machine: *UNIX (SUN)*
Operating System: *Solaris 2.7.8*

Oracle version: *Current*
Database Account: *TBD (e.g., GT, REFDB, ….)*
Other COTS software required: Unix shell, Perl, Fortran and C compilers.

E) Test Case Input Values:

I. *Locations and arrival times*
II. *Scripts to run the tests*

F) Test Case Results:

Plots that show the locations
Updated location databases

G) Test Case Procedure:

TBD (will involve running a set of scripts)

H) Expected output values:

I. *Flat file of test results.*
II. *Metrics: changes in location*

I) Test Case Evaluation Criteria:

TBD

Research and Development Test bed
Integration Test Plan

General Integration Test Information

A) Test plan author: *TBD*
B) Test plan completion date: *June, 2001*
C) Component description:
This test is carried to evaluate the performance of the ARS when a large number of SSSCs, for stations in the Group2 region, are turned on. The test will be performed using data from the REB catalog.
D) Integration test assumptions, limitations, exceptions, constraints:
I. An REB dataset for 1-2 day's duration is available for the test (the exact nature of the dataset is TBD)
II. A tool to measure the computational performance exists at the R&D TB.
III. The SSSCs will be only for the stations in the Group2 region.
E) Test requirements
I. Computational performance of ARS does not degrade significantly.
II. Does not harm the system, i.e., does not affect events outside region.

Integration Description

A) Interfaces
I. Scripts
II. ARS configuration

parameter files: ars.defs (velocity model specification file), ARS.par

config tree: $CMS_CONFIG/earth_specs/TT/vmsf/
$CMS_CONFIG/earth_specs/TT/iasp91/SSSC
$CMS_CONFIG/app_config/interactive/ARS

B) Input/output:
I. REB locations
II. *ARS outputs*

Integration Test Objectives

A) General Objectives:
Implementation of the SSSCs in the PIDC 7.0 software.
B) Integration Test Cases:
TBD (From REB events)

Test Case

A) Test Case Description:
Obtain computational performance metrics of the location software when the SSSCs are turned on
B) Test Case Environment:

General: PIDC7.0
Machine: *Sun*
Operating System: *Solaris*
Oracle Version: *Current*
Database Account: TBD (*separate account is required for integration testing)*

C) Expected Input:
SSSCs, REB arrivals

D) Procedure:
TBD (will require analyst to relocate events from REB in and outside region)

E) Expected Results:
Locations, log file, output database tables

F) Evaluation and Criteria:
TBD (changes do not harm events outside region, changes do not produce relocations larger than some expected tolerance)

Group-2 Consortium stations